Original Article

Inhaler Technique Comparison Between Dry Powder Inhaler and Metered Dose Inhaler Among Adults with Obstructive Airway Disease in a Tertiary Government Hospital Outpatient Setting

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ABSTRACT

Background: In the management of obstructive airway diseases, inhaled medication remains a cornerstone of therapy. Aside from medication type, the manner of delivery through various devices is important. Evaluating current practice provides a measure of performance and allows identification of areas for improvement. The study evaluated inhaler techniques of patients on dry powder inhalers (DPI) versus metered dose inhalers (MDI) at the outpatient setting. The prevalence of specific inhaler technique errors was assessed along with associated factors.

Methodology: This study was conducted with a cross-sectional design, involving patients with use of DPI and/or MDI for the past six months. Inhaler technique was evaluated and a short instruction on proper technique was provided with repeat evaluation immediately after.

Results: A total of 124 participants were assessed, resulting in 76 DPI and 52 MDI technique observations. Overall, a higher prevalence of any error was observed for DPI at 88.2% versus MDI at 86.5%. Immediately post-instruction, repeat assessment showed significant improvement, with reduction of any error to 57.9% (DPI) and 50% (MDI) ($p < 0.001$ for both). The most common DPI errors were failure to perform full exhalation prior (77.6%) and lack of sufficient breath holding after (44.7%). The most common MDI errors were failure to perform full exhalation prior (71.2%) and improper inhalation (53.8%). For MDI users, only advanced age had an association with having any error (OR 1.10, CI 1.03 to 1.17).

Conclusions: Inhaler technique errors remain high in the outpatient setting regardless of device, with older participants at risk of having errors with MDI, but not with DPI. Although technique review and instruction show promise in reducing errors, the durability of these skills is known to decay. Appropriate patient and device selection, along with regular technique assessment and reinforcement by healthcare professionals, remains the recommended practice to maximize the benefit of inhalers.

Keywords: inhaler technique, obstructive airway disease, metered dose inhaler, dry powder inhaler

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INTRODUCTION

Background and significance

Inhaled medication remains a cornerstone in the treatment of obstructive airway disease. The latest Global Initiative for Asthma (GINA) guidelines cite inhaler technique as one of the most important factors in improving asthma control in patients.[1,2] Medical progress has led to the advancement of medication delivery of key drugs—such as corticosteroids, beta agonists, and muscarinic receptor antagonists—whether as single agents or in combinations via a variety of devices.

Physicians continue to strive for the selection of the appropriate medication and dose for each patient to maximize symptom control, reduce exacerbations, as well as minimize unwanted side effects. A key part of this approach is the selection of the appropriate medication delivery device to meet the patient's needs and capabilities.

Significance and impact of the study

The study aims to identify the prevalence of incorrect steps of inhaler technique between dry powder inhaler (DPI) and metered dose inhaler (MDI) among patients with obstructive lung disease at the outpatient department. In doing so, the study aims to add to existing knowledge in the institution by identifying the specific inhaler technique errors with DPIs and MDIs and their possible associated patient- and management-related factors.

Once these errors are identified and their prevalence and impact determined, measures to improve healthcare delivery can be studied and implemented. Direct benefits to study participants include immediate correction of identified errors and reinforcement of proper technique. By improving adherence to proper inhaler technique, wastage of inhaler doses can be minimized, and improvement in disease control and exacerbation outcomes may be realized.

Objectives

The study aimed to answer the question of how adherent in terms of proper inhaler technique are patients on DPIs compared to those on MDIs. Specifically, the research aimed to identify the prevalence of errors for each step of proper inhaler technique among DPI and MDI users; identify factors possibly associated with inhaler technique error with DPI and MDI; and compare inhaler technique error before and after instruction, for both DPI and MDI.

METHODOLOGY

Study design and setting

The study had a primarily cross-sectional design. The study site involved the Philippine General Hospital Outpatient Department Clinics of the following services: Pulmonary

Medicine, General Medicine, and Family Medicine.

Inclusion and exclusion criteria

Study participants were adult patients diagnosed with an obstructive lung disease prescribed with an DPI and/or MDI for the past 6 months at the outpatient setting. Patients unable to use inhaler properly due to neurologic status or functional impairment including, but not limited to, use of tracheostomy, depressed sensorium, facial anatomic abnormalities precluding proper use of inhaler, and surgical resection of any lung segment, were excluded from the study.

Withdrawal criteria

Participants were allowed to withdraw from the study at any time and for any reason during their participation.

Data collection process

Participants enrolled in the study were assessed for their inhaler technique by investigators trained by a pulmonary medicine physician on the proper use of different inhaler devices. Participants' clinicodemographic data were recorded during the visit, including the date and time of the visit, diagnosis, smoking history, inhaler drug and device used, medical personnel who prescribed inhaler and evaluated technique, last recalled review of inhaler technique, compliance with inhaler prescription, need for assistance by family or caretakers during inhaler use, use of online or printed inhaler device instruction materials, recent exacerbations, and the latest forced expiratory volume in 1 second (FEV_1) value, if available.

Assessment of technique was performed by evaluating participants' actual inhaler use as last instructed by their respective healthcare provider. Assessment was done at the outpatient department examination areas where patients and their techniques are usually examined. Inhaler technique was evaluated onsite by the first trained investigator, while recording the interaction on video for further review and evaluation by a second trained investigator. Disagreements between the evaluation of the two investigators were mediated by a third trained investigator. Participants assisted by companions during regular use were allowed to be assisted and coached during the procedure. Participants who regularly used an MDI with a spacer were allowed to use their respective spacer during the evaluation.

A predetermined list of steps per inhaler device was used to evaluate inhaler technique pre-instruction. These steps were based on inserts as provided for by the manufacturers of the device and instructions by medical societies.[3,8-12] As done by a previous study by Tan et al,[13] each inhaler technique step was evaluated as "properly done" or "not properly done."

Once initial onsite assessment and recording had been done, participants received feedback from the investigator. A short verbal instruction followed where participants were guided through the proper steps of their respective device's inhaler technique. Repeat evaluation was done immediately after by the first trained investigator, with video recording which was further evaluated by the second trained investigator. Steps were marked as "properly done" or "not properly done" as before. This second set of inhaler technique data was recorded as post-correction/post-instruction.

The primary outcome was the prevalence of error at each step of inhaler use, as well as the overall prevalence of any error, both for DPI and MDI. Factors associated with inhaler technique error were analyzed per device type. Secondary outcomes were changes in the prevalence of any error in inhaler technique post-instruction.

STATISTICAL ANALYSIS

Based on the prevalence of critical error with inhaler use from a previous study[13] and a margin of error of 10%, the minimum sample size was estimated to be 77 and 50 technique observations for the DPI and MDI arms, respectively. Participant profiles and demographics were summarized using descriptive statistics. Counts and frequencies were used for categorical variables. Medians and interquartile ranges (IQR) were presented for non-normally distributed numeric variables. Normality was determined graphically using histograms and quantile-quantile plots.

One-way analysis of variance (ANOVA) and chi-square test were used to compare patient characteristics by inhaler device type. The McNemar test for paired data was used to compare the prevalence of inhaler technique errors before and after instruction due to small, expected values. Univariable logistic regression was used to determine factors associated with inhaler technique error. Two-tailed p-values <0.05 were considered statistically significant.

Data analysis was conducted using R version 4.2.2 with RStudio (Posit Team 2023).

Ethical considerations

The study protocol underwent review and approval by the University of the Philippines Manila Research Ethics Review Board (UPMREB code 2023-0855-01) and followed the principles of medical research set by the Declaration of Helsinki. Written informed consent was obtained from participants by members of the study team and trained research assistants before collecting information and recording video demonstrations of inhaler use.

RESULTS

A total of 124 unique participants were evaluated, with 128 inhaler technique observations recorded (72 patients on DPI, 48 patients on MDI, 4 patients on both) (Table 1). The median age of participants was 63 years for DPI users, 61 years for MDI users and, 50 years for those using both devices.

The majority of patients were prescribed inhalers for a diagnosis of bronchial asthma (76/124; 61.3%), followed by chronic obstructive pulmonary disease (46/124; 37.1%), and small airways disease (2/124; 1.6%). More than half of the participants were never smokers (76/124; 61.3%).

The most common inhaler drug used was an inhaled corticosteroid (ICS)/long-acting beta-agonist (LABA) combination, with budesonide/formoterol used by 45.2% (56/124) of participants. Most of these medications were first prescribed by and last checked by a Pulmonary Medicine Fellow (46.0% and 41.9%, respectively). Only 17 participants (13.7%) were initially prescribed an inhaler by a doctor not practicing Pulmonary Medicine or Primary Care (i.e., Internal Medicine or Family Medicine).

A majority of participants had undergone inhaler technique assessment during previous consultation (105/124; 84.7%). Among DPI users, 37.5% (27/72) were evaluated by a Pulmonary Medicine Fellow compared with 45.8% (22/48) for

Table 1. Clinico-demographic profile of participants

	Overall (n = 124)	DPI (n = 72)	MDI (n = 48)	Both (n = 4)	p-value
Age, years (median [IQR])	62.00 [50.75, 69.00]	63.00 [51.00, 71.00]	61.00 [51.00, 68.00]	50.50 [44.75, 55.50]	0.086
Sex, male (n, %)	48 (38.7)	33 (45.8)	15 (31.2)	0 (0.0)	0.075
Diagnosis (n, %)					
Bronchial asthma	76 (61.3)	34 (45.8)	40 (83.3)	3 (75.0)	0.001
Chronic obstructive pulmonary disease	46 (37.1)	38 (52.8)	7 (14.6)	1 (25.0)	
Small airways disease	2 (1.6)	1 (1.4)	1 (2.1)	0 (0.0)	
Educational attainment (n, %)					
College	40 (32.3)	21 (29.2)	18 (37.5)	1 (25.0)	0.906
Elementary	20 (16.1)	10 (13.9)	9 (18.8)	1 (25.0)	
High school	54 (43.5)	35 (48.6)	17 (35.4)	2 (50.0)	
Junior high	5 (4.0)	2 (2.8)	3 (6.2)	0 (0.0)	
None	1 (0.8)	1 (1.4)	0 (0.0)	0 (0.0)	
Postgraduate	4 (3.2)	3 (4.2)	1 (2.1)	0 (0.0)	
Smoking history (n, %)					
Current	4 (3.2)	3 (4.2)	1 (2.1)	0 (0.0)	0.054
Previous	44 (35.5)	33 (45.8)	10 (20.8)	1 (25.0)	
Never	76 (61.3)	36 (50.0)	37 (77.1)	3 (75.0)	
Pack-years, among smokers (median [IQR])	10.00 [5.00, 26.50]	10.00 [5.00,21.50]	10.00 [5.00, 43.50]	20.00 [20.00, 20.00]	0.781
Inhaler drug (n, %)					
Beclomethasone/formoterol	5 (4.0)	0 (0.0)	5 (10.4)	0 (0.0)	<0.001
Budesonide/formoterol	56 (45.2)	31 (43.1)	23 (47.9)	2 (50.0)	
Fluticasone furoate/umeclidinium/vilanterol	8 (6.5)	8 (11.1)	0 (0.0)	0 (0.0)	
Indacaterol/glycopyrronium	28 (22.6)	26 (36.1)	0 (0.0)	2 (50.0)	
Salmeterol/fluticasone	19 (15.3)	5 (6.9)	14 (29.2)	0 (0.0)	
Others	8 (6.5)	2 (2.8)	6 (12.5)	0 (0.0)	
Inhaler prescribed by (n, %)					
Fellow Pulmonologist	57 (46.0)	33 (45.8)	20 (41.7)	4 (100.0)	0.412
Resident Internal Medicine	27 (21.8)	19 (26.4)	8 (16.7)	0 (0.0)	
Resident Family Medicine	5 (4.0)	3 (4.2)	2 (4.2)	0 (0.0)	
Private pulmonologist	18 (14.5)	9 (12.5)	9 (18.8)	0 (0.0)	
Others	17 (13.7)	8 (11.1)	9 (18.8)	0 (0.0)	
Technique evaluated by (n, %)					
Fellow Pulmonologist	52 (41.9)	27 (37.5)	22 (45.8)	3 (75.0)	0.390
Resident Internal Medicine	19 (15.3)	11 (15.3)	7 (14.6)	1 (25.0)	
Resident Family Medicine	3 (2.4)	2 (2.8)	1 (2.1)	0 (0.0)	
Private Pulmonologist	10 (8.1)	4 (5.6)	6 (12.5)	0 (0.0)	
Nurse	6 (4.8)	6 (8.3)	0 (0.0)	0 (0.0)	
Pharmacist	3 (2.4)	3 (4.2)	0 (0.0)	0 (0.0)	
Others	12 (9.7)	5 (6.9)	7 (14.6)	0 (0.0)	
None	19 (15.3)	14 (19.4)	5 (10.4)	0 (0.0)	
Last checked, days (median [IQR])	90.00 [30.00, 230.00]	90.00 [32.25, 235.00]	120.00 [38.00,360.00]	55.00 [27.50, 82.50]	0.332
Compliance (n, %)					
As ordered	89 (71.8)	50 (69.4)	37 (77.1)	2 (50.0)	0.090
Missed most days	14 (11.3)	12 (16.7)	2 (4.2)	0 (0.0)	
Used most days	21 (16.9)	10 (13.9)	9 (18.8)	2 (50.0)	
Assistance, yes (n, %)	9 (7.3)	6 (8.3)	3 (6.2)	0 (0.0)	0.775
Used online or printed resources, yes (n, %)	21 (16.9)	15 (20.8)	5 (10.4)	1 (25.0)	0.299
Recent exacerbation (n, %)	47 (37.9)	34 (47.2)	13 (27.1)	0 (0.0)	0.024

MDI users and 75% (3/4) for two-device users. Only 19.4% (14/72) DPI users and 10.4% (5/48) MDI users never underwent inhaler technique assessment on their current device prior to study participation.

Self-reported compliance to prescribed frequency of use was 71.8% (89/124) overall. Between the two devices, MDI users had a higher self-reported compliance at 77.1% (37/48) compared to 69.4% (50/72) for DPI users.

The provision of routine assistance by a family member or caretaker during inhaler use was low (8.3% and 6.2% for DPI and MDI, respectively). The use of online or printed resources such as instructional videos was more common among DPI users (20.8%) versus MDI users (10.4%).

Only 6.1% of participants had recent spirometry done with available FEV_1 values; the rest did not have any spirometry in the last five years or were still pending formal evaluation by spirometry at the time of encounter. Assessment of the interquartile range revealed that the first quartiles of follow-up for DPI, MDI, and two-device users were similar at around 30 days, while the third quartile was different at 235 days for DPI users, 360 days for MDI users, and 82 days for two-device users.

Participants were last evaluated for their inhaler technique at a median interval of 90 days for DPI users, 120 days for MDI users, and 55 days for two-device users.

In the six months prior to study participation, 47.2% of DPI users reported at least 1 episode of exacerbation compared to 27.1% of MDI users (p = 0.024).

In the DPI group, a total of 76 observations were analyzed, with 72 from purely DPI users and 4 from both-device users. The prevalence of any error in inhaler technique was 88.2% (67/76), which significantly improved to 57.9% (44/76) immediately post-correction/post-instruction (p value <0.001) (Figure 1).

In the MDI group, a total of 52 observations were analyzed, with 48 from purely MDI users and 4 from both-device users. There was a similarly high prevalence of any error in inhaler technique at 86.5% (45/52), with significant improvement to 50.0% (26/52) immediately post-correction/post-instruction (p value <0.001) (Figure 1).

As noted in Table 2, majority of errors noted with DPI use pre-instruction occurred in step 4 (59 observations) or performing full exhalation prior to use. This was followed by step 7 (34 observations) or lack of sufficient breath holding, and step 6 (26 observations) or proper inhalation technique.

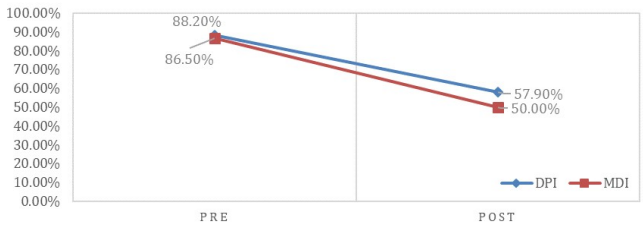

Figure 1. Prevalence of any inhaler technique error, pre- and post-instruction, by inhaler device (DPI/MDI). DPI, dry powder inhaler; MDI, metered dose inhaler participants

Table 2. Prevalence of error at each step of DPI use pre-instruction (n = 76)

Steps	Error, n (%)
Step 1 (Remove inhaler cover)	0 (0)
Step 2 (Priming next dose if applicable)	1 (1.3)
Step 3 (Proper positioning, no shaking)	4 (5.3)
Step 4 (Exhale fully prior to use)	59 (77.6)
Step 5 (Positioning between lips with good seal)	8 (10.5)
Step 6 (Deep and forceful inhalation)	26 (34.2)
Step 7 (Breath holding for 8-10 seconds)	34 (44.7)
Step 8 (Removal of mouthpiece)	5 (6.6)
Step 9 (Slow exhalation)	10 (13.2)

Table 3. Prevalence of error at each step of MDI use pre-instruction (n = 52)

Steps	Error, n (%)
Step 1 (Remove inhaler cover)	0 (0)
Step 2 (Shake container)	19 (36.5)
Step 3 (Exhale fully prior to use)	37 (71.2)
Step 4 (Proper inhaler positioning)	4 (7.7)
Step 5 (Simultaneous activation and inhalation)	5 (9.6)
Step 6 (Slow and deep inhalation)	28 (53.8)
Step 7 (Breath holding for 8-10 seconds)	18 (34.6)
Step 8 (Removal of mouthpiece with slow exhalation)	3 (5.8)

For MDI use (Table 3), most of the errors pre-instruction occurred in step 3 (37 observations) or, similar to DPI, performing full exhalation prior to use. There were 28 incorrect observations for step 6 or proper slow and deep inhalation of medication. More than a third (19 observations) failed to shake the container prior to use (step 2).

Among the patient- and management-related factors investigated (Table 4), only age had a statistically significant association with error in MDI technique. For every year older, the risk of having any error in MDI technique increased by 10% (OR 1.10, 95% CI 1.03 to 1.17).

DISCUSSION

The results of the study showed a high prevalence of inhaler technique error among both DPI and MDI users at the Philippine General Hospital Outpatient Department clinics of the following services: Pulmonary Medicine, General Medicine and Family Medicine. The prevalence rates noted in this study were higher compared to previous findings by Tan et al (72.4% and 84.6% for DPI and MDI, respectively).[13] Similar findings were found in multiple studies over the years, with prevalence of error ranging from 40% to 80% for both devices depending on observer findings and definition of technique acceptability[4-7,13,14,15] Although there was a significant reduction of inhaler technique errors immediately post-instruction for both groups, durability and retention of knowledge and skills must be properly assessed in longitudinal studies to significantly impact patient care.

Table 4. Association of patient- and management-related factors with any pre-instruction error in inhaler technique

Factor	DPI Unadjusted odds ratio (95% confidence interval)	MDI Unadjusted odds ratio (95% confidence interval)
Age in years	1.00 (0.95 to 1.05)	1.10 (1.03 to 1.17)
Age >60 years old	1.26 (0.31 to 5.13)	7.50 (0.83 to 67.49)
Male	7.31 (0.87 to 61.75)	0.48 (0.09 to 2.49)
Educational attainment		
Elementary	Ref	Ref
High school	2.40 (0.35 to 16.39)	1.58 (0.22 to 11.36)
College/postgraduate	1.05 (0.16 to 6.72)	2.25 (0.27 to 18.92)
Diagnosis		
COPD	0.82 (0.20 to 3.34)	…
Non-COPD	Ref	…
Asthma	…	…[2]
Smoking history		
Never smoker	Ref	Ref
Current smoker	0.44 (0.03 to 5.52)	(ever smoker)[1]
Previous smoker	7.22 (0.84 to 62.03)	0.71 (0.12 to 4.25)
Compliance		
As ordered	Ref	Ref
Used most days	1.17 (0.12 to 11.05)	(Not as ordered)[1]
Missed most days	0.32 (0.06 to 1.58)	2.18 (0.24 to 20.05)
Used online or printed resources	0.92 (0.17 to 4.95)	0.75 (0.07 to 7.57)

[1]Analysis for Smoking history and Compliance for MDI users adjusted due to small counts. "Current smoker" and "previous smokers" collapsed into "ever smoker" category and "used most days" and "missed most days" into "Not as ordered" category.
[2]Unreliable estimates for diagnosis of asthma as a factor due to too few non asthmatics in MDI user population, and all had at least 1 error during observation.
COPD, chronic obstructive pulmonary disease

Common errors in inhaler technique found for both DPI and MDI mirrored previous findings. In the study of Tan et al in the same institution years prior, the most common critical errors for MDI were poor coordination between actuation and inhalation and improper breathing technique—issues that persisted in our assessment seven years later. Similarly, DPI errors showed persistence of improper breathing technique. Errors common to both devices and that remained prevalent in this study were failure to exhale fully prior to inhaler use and lack of sufficient breath holding prior to exhalation of medication.[13]

Like previous findings by Lee et al, older age showed a significant association with error in inhaler technique with MDI but not with DPI. However, our study had a lower mean age of 61 years than the mean age of 76 years reported by Lee et al.[6] Possible reasons include deterioration of motor and cognitive skills leading to difficulty in synchronized inhalation and activation of inhaler device. Other factors investigated include education level and use of online or printed materials. However, we were unable to find an association with other factors possibly due to the distribution of our sampled population.

Regarding strategies to help reduce inhaler technique errors, only a small part of the study population reported utilization of instructional materials (i.e., videos or infographics) and assistance from caregiver. Improving access and utilization of these valuable resources can be of use in reducing inhaler technique errors and improving durability of skill and retention of knowledge.

Although not directly investigated as a possible associated factor, a notable finding is the wide interval between inhaler assessment for both devices, reaching up to 235 days for DPI and 360 days for MDI. Existing guidelines recommend reviewing patient inhaler technique at every visit as part of assessment of obstructive airway diseases.[1,2] Recommended intervals between follow-up for adjustment of inhaler medication range from 1 to 3 months. Median interval from last inhaler technique assessment was within recommendation for DPI and two-device users but longer for MDI users. Alarmingly, the third quartile of the population reached 235 days for DPI users and 360 days for MDI users since the last inhaler technique assessment. These patients may still have been seen by their respective physicians during this time, but no review of actual inhaler technique was conducted leading to large gaps in the follow-up period without periodic review and instruction.

Despite being seen in the clinics, 15.3% of the population reported no regular assessment or review of inhaler technique during their last outpatient clinic healthcare visit. A review of the practice in specialty as well as primary care clinics could help address these findings and aid in reinforcing proper inhaler technique and regular inhaler technique assessments. Looking into the knowledge, skills, and practice regarding inhaler technique assessment and providing instructions for healthcare professionals in these clinics ranging from trainees (residents/fellows), nursing staff, pharmacists, and even medical students can also be done.

Even a short period of providing verbal instructions and guiding patients through proper inhaler technique steps for both DPI and MDI showed a significant improvement in prevalence of errors from 88.2% to 57.9% and 86.5% to 50.0%, respectively. Despite the improvement, however, error rates remained high after step-by-step verbal guidance and instruction. Previous investigation on patients using MDIs by Jolly et al showed the need for repeated stepwise instruction and demonstration in a single sitting to achieve zero errors during return demonstration of proper inhaler technique.[14] In their study, only 24.1% of their 117 participants were able to achieve zero errors after a single intervention (written instruction or demonstration), implying that repeated reinforcement is necessary, particularly for certain steps requiring skill and coordination. For DPIs, a finding by Collier et al showed that different DPI device types may have different error rates due to intrinsic differences (such as Turbuhaler® which requires upright positioning during dose preparation, or HandiHaler® which requires the capsule to be punctured prior to inhalation).[15] Work done by Melani et al showed that instructing patients with faulty baseline techniques would require a longer time for MDIs (8.1 min) than DPIs (5.0 min for Diskus®, 5.3 min for HandiHaler®, and 6.0 min for Turbuhaler®), possibly due to the need for greater coordination for MDIs.[16]

Many other factors such as the provider's experience with instruction, mode of instruction, patient's age, previous inhaler device experience, and number of devices may also contribute.[15-17] A more in-depth study examining the effectiveness of available instruction strategies and related factors is needed to determine their efficacy in our setting.

Further, a single encounter providing proper instruction may be insufficient as inhaler technique is known to improve in the short term, but with a substantial decay noted in the next two to 12 months.[17]

Limitations

The study assessed the technique of ongoing inhaler use by participants as prescribed by their physician during a single time point. Assessment of compliance using means other than recall, as well as testing for optimal inspiratory flow rate for compatibility with the inhaler, was not conducted.

The study also reached only 76 DPI observations, compared to the minimum estimated requirement of 77, due to logistic issues, which may have led to an underpowered statistical analysis for the DPI group. Prevalence rates observed however, remain useful for evaluation and reassessment on ongoing inhaler instruction.

Recommendations

First, the study recommends further investigation into inhaler technique compliance and skill retention through a longitudinal assessment and review of related factors. The study also recommends a more in-depth analysis of barriers to effective inhaler technique for different device types through focus group discussions. Skills and knowledge assessment of healthcare providers can also be investigated. Lastly, the establishment of dedicated Asthma/COPD Clinics would help in record-keeping, enhancing service delivery, and providing an avenue for further research to ultimately improve patient care.

CONCLUSION

The prevalence of inhaler technique errors remains high in the outpatient setting regardless of device used, with older patients at risk of having errors with MDI, but not with DPI. Although inhaler technique review and instruction show promise in reducing the prevalence of errors, repeated instruction and demonstration are needed, along with interval assessment and reinforcement, as the durability of inhaler technique knowledge and skills is known to decay over time. Careful patient selection and matching with the appropriate inhaler device, along with proper and regular inhaler technique assessment and reinforcement, remains the recommended practice to maximize their utility. Routine visits to any healthcare worker trained in proper inhaler technique and instruction provide excellent opportunities to ensure optimal inhaler technique and adherence.

Local longitudinal studies that focus on inhaler technique assessment are recommended to better establish temporal trends and more clearly describe factors associated with the decay of technique over time, in order to identify points for intervention and healthcare improvement. Studies examining the effectiveness of different instructional strategies in the Philippine setting are also recommended to find accessible and effective solutions.

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Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Authors' Disclosure

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